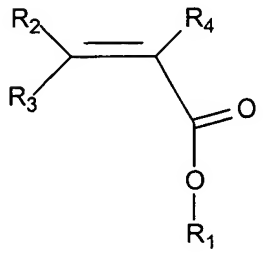
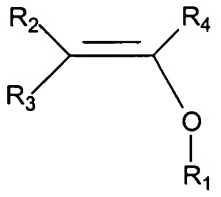
Claims

1. A photoresist composition comprising:
   a) a polymer that is insoluble in an aqueous alkaline solution and comprises at least one acid labile group, and comprises at least one monomer unit having a pendant group selected from unsubstituted or substituted higher adamantanes and mixtures thereof; and
   b) a compound capable of producing an acid upon irradiation.

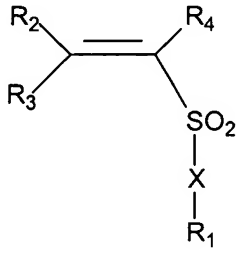
2. The photoresist composition of claim 1 wherein the monomer unit is selected from



(1A)



(1B)

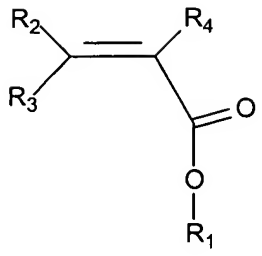


(1C)

wherein

R_1 is –Z or –Y–Z where Y is a linear or branched alkylene or a monocyclic or polycyclic alkylene, Z is unsubstituted or substituted higher adamantane; R_2, R_3, and R_4 are each independently selected from hydrogen, alkyl, alkoxyalkyl, cycloalkyl, cycloalkenyl, aryl, aralkyl, and CN or any two of R_2, R_3, and R_4 together with the carbon atoms to which they are attached form an unsubstituted or substituted mono- or polycycloalkenyl; X is O or NR_2.

3. The photoresist composition of claim 2 wherein the monomer unit is

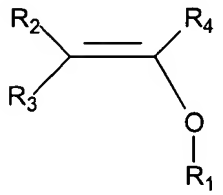


(1A)

4. The photoresist composition of claim 3 wherein the higher adamantane is selected from diamantane and triamantane.

5. The photoresist composition of claim 4 wherein the higher adamantane is substituted by one or more groups selected from hydroxy, hydroxyalkyl, alkyl, alkoxy, aryl, cycloalkyl, cycloalkyloxy, alkoxyalkyl, alkoxycycloalkyl, aryloxy, halogen, $-O-(CH_2)_n-COOtBu$, where n is 1 to 5, and where a carbon atom within the higher adamantane is replaced by $A-(CH_2)_j-C(=O)-O-B$ where j is 0 to 5 and A and B represent direct bonds to adjacent carbon atoms to the replaced carbon atom.

6. The photoresist composition of claim 1 wherein the monomer unit is



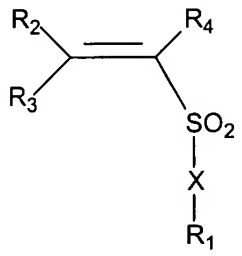
(1B)

7. The photoresist composition of claim 6 wherein the higher adamantane is selected from diamantane and triamantane.

8. The photoresist composition of claim 7 wherein the higher adamantane is substituted by one or more groups selected from hydroxy, hydroxyalkyl, alkyl,

alkoxy, aryl, cycloalkyl, cycloalkyloxy, alkoxyalkyl, alkoxycycloalkyl, aryloxy, halogen, $-O-(CH_2)_n-COOtBu$, where n is 1 to 5, and where a carbon atom within the higher adamantane is replaced by $A-(CH_2)_j-C(=O)-O-B$ where j is 0 to 5 and A and B represent direct bonds to adjacent carbon atoms to the replaced carbon atom.

9. The photoresist composition of claim 1 wherein the monomer unit is



(1C)

10. The photoresist composition of claim 9 wherein the higher adamantane is selected from diamantane and triamantane.

11. The photoresist composition of claim 10 wherein X is O.

12. The photoresist composition of claim 10 wherein X is NR_2.

13. The photoresist composition of claim 10 wherein the higher adamantane is substituted by one or more groups selected from hydroxy, hydroxyalkyl, alkyl, alkoxy, aryl, cycloalkyl, cycloalkyloxy, alkoxyalkyl, alkoxycycloalkyl, aryloxy, halogen, $-O-(CH_2)_n-COOtBu$, where n is 1 to 5, and where a carbon atom within the higher adamantane is replaced by $A-(CH_2)_j-C(=O)-O-B$ where j is 0 to 5 and A and B represent direct bonds to adjacent carbon atoms to the replaced carbon atom.

14. The photoresist composition according to claim 1, where the compound capable of producing an acid upon irradiation is a sulfonium or iodonium salt;

15. The photoresist composition according to claim 1, where the compound capable of producing an acid upon irradiation is selected from triphenylsulphonium nonafluorobutanesulfonate, diphenyliodonium trifluoromethanesulfonate, diphenyliodonium nonafluorobutanesulfonate, triphenylsulfonium trifluoromethanesulfonate, triazines, oxazoles, oxadiazoles, thiazoles, substituted 2-pyrones, phenol sulfonic esters, bis-sulfonylmethanes, bis-sulfonylmethanes and bis-sulfonyldiazomethanes.

16. A process of imaging a positive photoresist composition comprising the steps of:

a) coating a substrate with a film of photoresist composition of claim 1;
b) baking the substrate to substantially remove the solvent;
c) imagewise irradiating the photoresist film;
d) baking the photoresist film; and,
e) developing the irradiated photoresist film using an alkaline developer.

17. The process according to claim 16, further comprising coating an antireflective film on the substrate prior to coating the photoresist.

18. The process of claim 16, wherein the photoresist film is imagewise irradiated with light of wavelength in the range of 10nm to 300nm.

19. The process of claim 18, wherein the wavelength is selected from the following: 248 nm, 193 nm, 157 nm, 13.4 nm.

20. The process of claim 18, where the imagewise irradiation is carried out with particle-type radiation.

21. The process of claim 16, wherein the baking in step d) ranges from a temperature of from about 90°C to about 150°C for from about 30 seconds to about

180 seconds on a hot plate or from about 15 minutes to about 40 minutes in an oven.

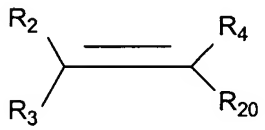
22. The process of claim 16, wherein the alkaline developer in step e) comprises an aqueous solution of tetramethyl ammonium hydroxide;

23. The process of claim 16, in which the photoresist is subjected to a further heating step after step e);

24. The process of claim 16, in which the photoresist is subjected to a curing process after step e) comprising irradiating it with short wavelength or electron-beam radiation;

25. A process for making the polymer of claim 1 in which the polymer is synthesized by free radical polymerization or copolymerization.

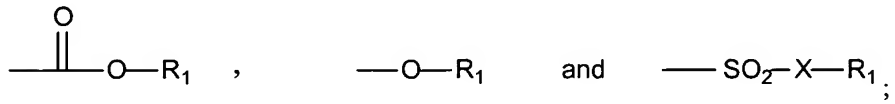
26. A compound of the formula



(1)

wherein

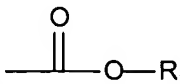
R_{20} is selected from

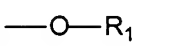


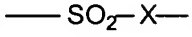
;

R_1 is –Z or –Y–Z where Y is a linear or branched alkylene or a monocyclic or polycyclic alkylene, Z is unsubstituted or substituted higher adamantane; R_2, R_3, and

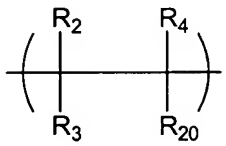
R_4 are each independently selected from hydrogen, alkyl, alkoxyalkyl, cycloalkyl, cycloalkenyl, aryl, aralkyl, and CN or any two of R_2, R_3, and R_4 together with the carbon atoms to which they are attached form an unsubstituted or substituted mono- or polycycloalkenyl; X is O or NR_2.

27. The compound of claim 26 wherein R_{20} is  .

28. The compound of claim 26 wherein R_{20} is  .

29. The compound of claim 26 wherein R_{20} is  .

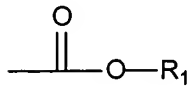
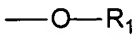
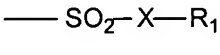
30. A polymer comprising at least one repeating unit represented by formula (2)



(2)

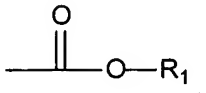
wherein

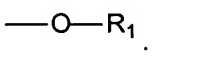
R_{20} is selected from

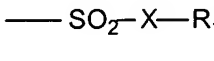
 ,  and  ;

R_1 is –Z or –Y–Z where Y is a linear or branched alkylene or a monocyclic or polycyclic alkylene, Z is unsubstituted or substituted higher adamantane; R_2, R_3, and R_4 are each independently selected from hydrogen, alkyl, alkoxyalkyl, cycloalkyl, cycloalkenyl, aryl, aralkyl, and CN or any two of R_2, R_3, and R_4 together with the

carbon atoms to which they are attached form an unsubstituted or substituted mono- or polycycloalkenyl; X is O or NR_2.

31. The polymer of claim 30 wherein R_{20} is  .

32. The polymer of claim 30 wherein R_{20} is  .

33. The polymer of claim 30 wherein R_{20} is  .